Compact 3D Wind Sensor for Unmanned Aerial Vehicles, Phase I

Completed Technology Project (2015 - 2015)

Project Introduction

Accurate wide-area mapping of three-dimensional (3D) wind vectors plays an important role in our ability to understand climate processes, predict weather patterns and hazards, and unravel planetary atmospheric dynamics, both on Earth and extraterrestrially. To this end, NASA has several airborne Doppler lidar platforms (e.g., DAWN, MACAWS) that are capable of mapping 3D wind vectors. These systems are large, heavy, and costly, requiring full-sized crewed aircraft (e.g., DC-8) to operate them and provide 3D wind measurements only along a single direction, thus limiting their utility. To address this barrier, Boulder Nonlinear Systems (BNS) proposes a 3D wind sensor system with low size, weight, and power (SWaP) requirements that can be deployed on small unmanned aerial vehicles (UAVs) for wider coverage and cheaper operation. The proposed system is built around exclusive electro-optic beam scanner technology and many commercial off-the-shelf components from the telecom industry. Current mechanical beam scanning solutions are heavy, power hungry, and slow, and constitute a significant portion of the mass of 3D wind sensors and other optical sensor platforms. In contrast, BNS' non-mechanical beam scanner can reduce scanner mass by an order of magnitude and power consumption by three orders of magnitude, while simultaneously providing new mission capabilities such as fast random-access scanning and hemispherical sensor coverage. Phase I will fully characterize the impact of the beam scanner on Doppler lidar measurements and demonstrate recovery of 3D velocity vectors using an existing low-SWaP short-range Doppler lidar prototype developed for long-range rifle ballistics. In Phase II, BNS will partner with an existing lidar wind sensor contractor for development of the full UAV wind sensor prototype using either BNS' existing lidar prototype or integrating BNS' low-SWaP beam scanner onto the partner's wind sensing platform, as desired by NASA.

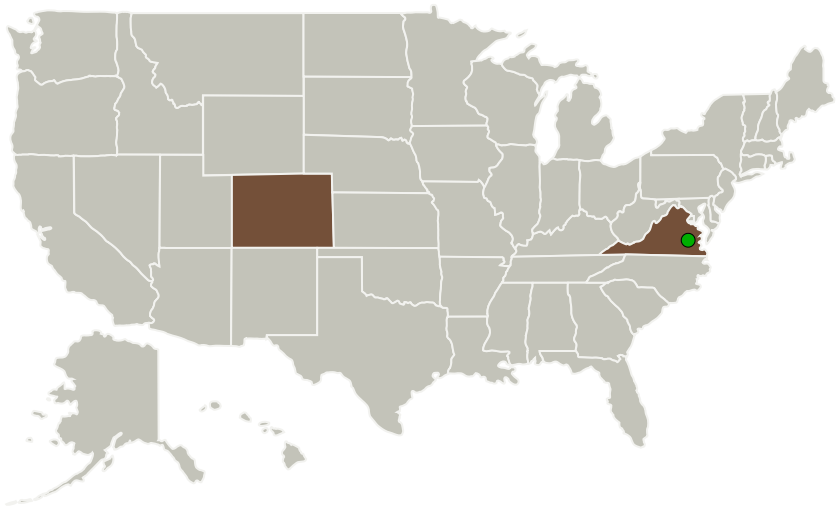
Compact 3D Wind Sensor for Unmanned Aerial Vehicles, Phase I

Table of Contents

Compact 3D Wind Sensor for Unmanned Aerial Vehicles, Phase I

Completed Technology Project (2015 - 2015)

Primary U.S. Work Locations and Key Partners



Organizations Performing Work	Role	Type	Location
Boulder Nonlinear Systems, Inc.	Lead Organization	Industry	Lafayette, Colorado
Langley Research Center(LaRC)	Supporting Organization	NASA Center	Hampton, Virginia

Primary U.S. Work Locations	
Colorado	Virginia

Project Transitions

June 2015: Project Start

December 2015: Closed out

Closeout Summary: Compact 3D Wind Sensor for Unmanned Aerial Vehicles, P hase I Project Image

Closeout Documentation:

- Final Summary Chart Image*(https://techport.nasa.gov/file/138878)*

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Organization:

Boulder Nonlinear Systems, Inc.

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

Project Management

Program Director:

Jason L Kessler

Program Manager:

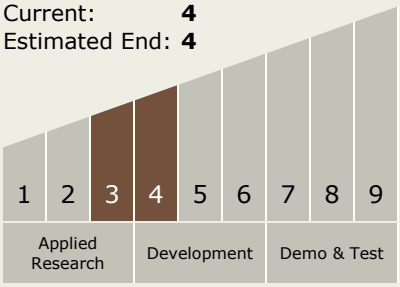
Carlos Torrez

Principal Investigator:

Steve Serati

Technology Maturity (TRL)

Start: **3**
Current: **4**
Estimated End: **4**



Compact 3D Wind Sensor for Unmanned Aerial Vehicles, Phase I

Completed Technology Project (2015 - 2015)

Images

Briefing Chart Image
Compact 3D Wind Sensor for Unmanned Aerial Vehicles, Phase I
(https://techport.nasa.gov/image/133341)

Technology Areas

Primary:

- TX08 Sensors and Instruments
  - TX08.1 Remote Sensing Instruments/Sensors
    - TX08.1.1 Detectors and Focal Planes

Target Destinations

The Sun, Earth, The Moon, Mars, Others Inside the Solar System, Outside the Solar System